

PALEONTOLOGY.—*New crinoids from the Pitkin of Oklahoma.* HARRELL L. STRIMPLE, Bartlesville, Okla. (Communicated by Alfred R. Loeblich, Jr.)

A prolific crinoid fauna has been discovered by Claude Bronaugh, of Afton, Okla., in the upper few feet of the Pitkin limestone formation in outcrops of the Cookson Hills southeast of Fort Gibson, Okla. Specimens have subsequently been collected by Mr. Bronaugh, Mrs. Hazel Bronaugh, Mrs. Melba Strimple, and the author on several field excursions. Several of the new forms are described below.

Telikosocrinus, n. gen.

Description.—Crown is of moderate length, expands rapidly. Dorsal cup composed of five small, upflared IBB, five large BB, five large RR, and three anal plates in normal (primitive) arrangement. Forty or more biserial arms are indicated. First bifurcation with the first primibrachial in each ray and a second branching with, or about, the fifth secundibrachial in all rays. Thereafter, the outer rays usually, but not always, continue to their termination without further bifurcation and the inner rays branch again. The next bifurcation normally takes place in only the outer arms and the fourth dichotomy, when present, occurs only in the ensuing inner rays.

Column is moderately pentagonal, pierced by a small pentalobate lumen. Anal tube terminates with a few irregular, upwardly or outwardly directed spinose plates.

Genotype.—*Telikosocrinus caespes*, n. sp.

Known range.—Chester, North America.

Remarks.—This genus has certain characteristics in common with *Pelecoocrinus* Kirk (1941) and *Hydreionocrinus* de Koninck (1858). All three genera have more or less erect, cone-shaped dorsal cups with three anal plates in normal (primitive) arrangement. *Pelecoocrinus* is readily separable in having a round stem, articulating facets which fail to fill distal faces of RR, uniserial arms, and 10 or more primibrachials above anterior radial. *Hydreionocrinus* is more difficult to distinguish and is probably closely related. The dorsal cup is shallow, interbasal sutures exceedingly short, or absent, and the biserial arms branch only in the inner rays after the second dichotomy.

The form described by Laudon (1941) as *Pelecoocrinus stereosoma* from the middle Pitkin is reported to have uniserial arms with sporadic biserial development. Since the articulating facets

of this species fill the distal faces of RR, and as there is no evidence of numerous PBrBr in the anterior ray, the species does not appear to belong with *Pelecoocrinus*. It seems better assigned as *Telikosocrinus stereosoma* (Laudon), n. comb.

Telikosocrinus caespes, n. sp.

Figs. 1-4

Description.—Crown moderately expanded, curving slightly inwardly at distal extremity and devoid of ornamentation. Dorsal cup high cone-shaped with a tendency toward a spherical outline. Sutures are mildly impressed giving cup plates a tumid appearance. Five IBB extend beyond the columnar scar and are visible in side view of the dorsal cup. Five BB are fairly large and five RR are wide, substantial plates. Three anal plates occupy the broad posterior interradius and are in primitive arrangement.

There are approximately 50 biserial arms. First PBrBr are wide, low, axillary and fill distal faces of RR. A biserial arrangement is rapidly attained by the SBrBr and second bifurcation takes place with the fifth to tenth SBrBr. In the holotype and most paratypes the outer rays remain unbranched and the next division of the inner rays takes place normally with about the ninth TBrBr. When another dichotomy occurs it is in an outer ray. A young paratype branches in either the outer or inner rays after the second dichotomy. Pinnules are delicate and not often preserved in place.

Anal sac is elongate, extending almost to the distal extremities of the rami. Several spinose, irregular plates mark the termination of the sac. Proximal columnals are mildly pentagonal and are alternately expanded. The lumen is pentalobate and small.

Measurements in mm.—As follows:

	Holo- type	Figured paratype	Para- type
Height of crown.....	—	21.5	29.6
Height of dorsal cup.....	3.9	3.2	2.8
Maximum width of cup.....	10.2	7.2	9.7
Width of IBB circle.....	5.2	2.7	2.8
Diameter of proximal columnal.....	2.7	1.9	2.0
Length of l. post. B ¹	3.2	1.5	2.1
Width of l. post. B.....	3.7	2.3	2.4
Length of interbasal suture ¹	1.2	0.5	0.9
Length of l. ant. R ¹	2.8	2.0	2.5
Width of l. ant. R.....	5.8	3.7	4.6
Length of interradiial suture ¹	1.4	1.3	1.4
Height of PBr.....	2.9	2.2	2.8
Width of PBr.....	5.9	3.8	4.5

¹ Excluding consideration of surface curvature.



FIGS. 1-4.—*Telikosocrinus caespes*, n. gen. and sp.: 1, 2, Holotype from posterior and anterior, $\times 1.8$; 3, 4, small paratype from anterior and posterior, $\times 1.7$. FIGS. 5-9.—*Phanocrinus irregularis*, n. sp.: 5-7, Small paratype from posterior, anterior, and base, $\times 1.7$; 8, 9, holotype from posterior and base, $\times 1.4$. FIGS. 10-12.—*Phanocrinus modulus*, n. sp., holotype from posterior, base, and anterior, $\times 1.8$. FIG. 13.—*Telikosocrinus residuus*, n. sp., holotype from posterior, $\times 1.7$.

Remarks.—This species has a dorsal cup somewhat similar to that of *T. stereosoma* (Laudon); however, the IBB of the latter species are more pronounced and the cup is more elongate. *T. stereosoma* has primarily uniserial arms and a stronger tendency toward bifurcation in the outer rays after the second main dichotomy. Only one of six observed specimens of *T. caespes* showed any decided tendency toward bifurcation in the outer main rays after the second branching and all arms were biserial.

T. residuus has a more evenly expanded dorsal cup and the arms have a flattened exterior not found in *T. caespes*.

Occurrence and horizon.—Approximately 4 miles southeast of Greenleaf Lake, Cookson Hills, Okla.; upper Pitkin limestone formation, Chester, Mississippian.

Types.—Holotype and one paratype collected by Melba Strimple. Figured paratype collected by Claude Bronaugh. To be deposited in the U. S. National Museum.

Telikosocrinus residuus, n. sp.

Fig. 13

Description.—Crown is devoid of ornamentation, expands rapidly and evenly from columnar attachment. Dorsal cup cone-shaped, composed of five IBB, which are visible in side view of cup, five large BB, five large RR, and three anal plates. Posterior interradius is broad and plates are in normal (primitive) arrangement with RA resting obliquely against r. post. B and post. B, supporting RX above. Proximal edge of anal X is in broad contact with post. B and RA to the right.

There are approximately 50 arms indicated, exteriors flattened, biserial. First PBrBr low, axillary, fill distal faces of RR. Second bifurcation takes place with fourth or fifth SBrBr, thereafter, outer rays remain unbranched and inner rays branch with about the ninth TBrBr. After the third bifurcation the inner rays remain unbranched but the outer rays branch again on about the tenth or eleventh QBrBr. Pinnules are rather delicate and of moderate length.

Proximal columnal is large, pentagonal. Anal sac has not been observed except for the spinose terminating plates.

Measurements in mm.—As follows:

	Holotype
Height of dorsal cup.....	5.4
Maximum width of cup.....	13.9
Width of IBB circle.....	5.8

	Holotype
Diameter of proximal columnal.....	3.8
Length of l. post. B.....	3.1
Width of l. post. B.....	4.8
Length of interbasal suture.....	1.7
Length of l. ant. R.....	3.0
Width of l. ant. R.....	5.5
Length of interradial suture.....	2.1
Height of PBr.....	3.2
Width of PBr.....	5.5

Remarks.—Comparison with *T. caespes* and *T. stereosoma* have already been given. *T. residuus* is closely comparable to *Hydreionocrinus woodianus* de Koninek (1858) in some respects. The dorsal cup of the latter species is shallower and the arms have a slightly different pattern in that after the third dichotomy the arms continue to bifurcate only in the innermost rays.

Occurrence and horizon.—Approximately 4 miles southeast of Greenleaf Lake, Cookson Hills, Okla.; upper Pitkin limestone formation, Chester, Mississippian.

Holotype.—Collected by Claude Bronaugh. To be deposited in the U. S. National Museum.

Genus Phanocrinus Kirk, 1941

Phanocrinus irregularis, n. sp.

Figs. 5-9

Description.—Crown elongate, tubular-shaped. Dorsal cup shallow, broad, base shallowly concave. Five IBB are small, confined to the basal concavity; five BB are large, distal extremities curved into basal concavity where they have broad median grooves; five RR are large, wide; and two small anal plates in posterior interradius. RA is in oblique but broad contact with post. B and supports the slightly larger anal X above.

Arms are 10, stout, uniserial, slow tapering. PBrBr are axillary, low, wide. First SBrBr are rather large tall plates but subsequent brachials are low broad plates. Pinnules are of moderate size.

Proximal columnals are round and pierced by a small pentalobate lumen. Tegmen is unknown. Entire crown is devoid of ornamentation.

Measurements in mm.—As follows:

	Holotype	Figured paratype
Height of crown.....	48.6	28.4
Height of dorsal cup.....	5.9	3.0
Maximum width of cup.....	16.8	11.2
Diameter of proximal columnal.....	2.1	1.7
Length of l. post. B ¹	6.0	?
Width of l. post. B ²	5.1	3.7
Length of interbasal suture ¹	3.4	?
Length of r. ant. R ¹	6.1	3.8
Width of r. ant. R ²	8.8	6.0
Length of interradial suture.....	3.0	2.5

	<i>Holo-</i> <i>type</i>	<i>Figured</i> <i>paratype</i>
Height of PBr.....	4.1	4.4
Width of PBr.....	8.9	6.0

¹ Measurements along curvature of plates.

Remarks.—Only five specimens of *Phanocrinus* have been found in the horizon under study. Of these four are readily identified as *P. irregularis* and have the advanced arrangement of anal plates wherein RA has migrated to the dominant posterior position with anal X resting on the upper surface of RA, and RX has been entirely eliminated from the cup. It is considered significant that RA has also become small, thus indicating probable resorption. Such modification of the plates of the posterior interradius has been termed "Developmental Trend A" by the author (1948).

Phanocrinus cooksoni Laudon (1941) is closely comparable but has a higher cup with BB participating strongly in the outer walls of the dorsal cup.

Occurrence and horizon.—Approximately 4 miles southeast of Greenleaf Lake, Cookson Hills, Okla.; upper Pitkin, limestone formation, Mississippian.

Types.—Holotype and figured paratype collected by Melba Strimple. To be deposited in the U. S. National Museum.

***Phanocrinus modulus*, n. sp.**

Figs. 10-12

Description.—Crown of moderate length, tubular-shaped, with distal extremity tapered to a point. Dorsal cup truncate bowl-shaped, with erect lateral sides. Five IBB are minute, confined to basal concavity and almost entirely covered by proximal columnals. Five BB large, curve strongly out of basal concavity to form a good portion of the lateral walls of the cup. Five RR large, only slightly wider than high. Three anal plates occupy the posterior interradius. RA is large, elongate, rests obliquely on post. B and

r. post. B. Anal X is in contact with post. B but is strongly encroached upon by RA to the right. RX is in narrow contact with distal face of RA.

There are ten uniserial arms. PBrBr are large, axillary. SBrBr have strongly curved exteriors and are rather stout plates.

Proximal columnals are round, small, heavily crenulated. Tegmen is unknown.

Measurements in mm.—As follows:

	<i>Holo-</i> <i>type</i>
Height of crown.....	20.1
Height of dorsal cup.....	3.6
Maximum width of cup.....	8.3
Diameter of proximal columnal.....	1.5
Length of l. post. B.....	4.8
Width of l. post. B.....	3.8
Length of interbasal suture.....	2.7
Length of r. ant. R.....	2.7
Width of r. ant. R.....	4.0
Length of interradial suture.....	1.8
Height of PBr.....	2.7
Width of PBr.....	4.0

Remarks.—*P. modulus* is a small species readily distinguished from other described species by the large RA, short stout arms and the outline of the dorsal cup in side view. The nature of the plates in the posterior interradius indicates modification toward "Developmental Trend B" as outlined by the author (1948), and is almost identical to figure 4 of that study.

Occurrence and horizon.—Approximately 4 miles southeast of Greenleaf Lake, Cookson Hills, Okla.; upper Pitkin limestone formation, Chester, Mississippian.

Holotype.—Collected by the author. To be deposited in the U. S. National Museum.

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